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FINAL REPORT
on the
EFFECTIVENESS OF THE PEELING METHOD OF CONTROL
RELATIVE TO THE DESTRUCTION OF DENDROCTONUS BROODS IN LODGEPOLE PINE

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FINAL REPORT
on the
EFFECTIVENESS OF THE PEELING METHOD OF CONTROL
RELATIVE TO THE DESTRUCTION OF DENDROCTONUS BROODS IN LODGEPOLE PINE

INTRODUCTION

The year 1905 marked the institution of the first barkbeetle control project in the United States. This project was in the vicinity of Colorado Springs and Palmer Lake, Colorado, and the method of treatment used was felling the trees and peeling the infested portion of the bole.

The success of this method was based on the theory that the liberation of the immature *Dendroctonus* broods from their normal environment, and the exposure to the weather resulting from the removal of the bark, would soon result in their destruction. This assumption seemed reasonably sound and remained unquestioned until a few years ago when it was found that immature *Dendroctonus* broods, when released by peeling infested trees, could reach maturity if protected from predators.

To test the practice of peeling as a method of control, experiments were conducted by the writer during the summer of 1928 in an area heavily infested with the mountain pine beetle. This was in lodgepole pine on the Bitterroot National Forest near Sula, Montana.*

SCOPE

The experimental work in connection with this project was divided into two parts: (1) to determine the possibility of *Dendroctonus monticolae*

* "Preliminary Report on the Effectiveness of the Peeling Method of Control Relative to the Destruction of *Dendroctonus* Broods" By H. J. Rust, Senior Scientific Aid.

broods attaining maturity when released from their host by the peeling method and allowed to remain on the ground but protected from all predators; and (2) to determine the fate of the broods when liberated from the host by the peeling method and permitted to remain on the forest floor subjected to weather conditions and predators.

CAGED SURVIVAL EXPERIMENT CONDUCTED IN 1928

For the first part of the experiment, as conducted during the summer of 1928, a cage was constructed measuring six feet long, two feet wide, and one foot deep. This cage consisted of a light framework of wood covered with closely-woven wire screen and was divided into three separate compartments for larvae, pupae, and new adults. The cage was placed on the ground in an infested lodgepole pine area. Three inches of soil was placed on the floor of the cage and over the soil a layer of duff was placed consisting of fallen lodgepole pine needles and twigs. A number of Dendroctonus monticolae larvae, pupae, and new adults were placed in their respective compartments on various dates. A small section of freshly cut lodgepole pine was placed in each compartment to determine if immature Dendroctonus monticolae progeny reaching maturity under caged conditions would successfully attack.

During the preliminary examinations of the cage it was found that a number of small ants had gained entrance into the larval and pupal compartments. The final results showed that while 2.5 per cent of the larvae reached the pupal stage, none of the brood reached

maturity, the loss being attributed to the small ants and centipedes that had gained entrance into the cage. A large per cent of the pupae was also destroyed by ants, only 2.3 per cent reaching maturity and attacking the section of lodgepole pine placed in their compartment. In the new adult compartment it was found that 31.5 per cent had attacked the section of lodgepole pine and had constructed egg galleries which contained eggs and young larvae at the time of final examination.

The experiment was greatly retarded by the heavy rainfall and prevailing low temperatures causing a very moldy condition in the cage. but it is believed that a large per cent of the larvae and pupae would have reached maturity had no predators gained entrance into their compartments.

CAGED SURVIVAL EXPERIMENT CONDUCTED IN 1929

In conducting part one of this project during the summer of 1929 in the same area as for 1928, a different caging method was used. Two green standing lodgepole pine, 11 inches D.B.H., were selected and wire screen cages were constructed around the base of each tree (Figure 1). In constructing these cages a wire screen floor was fastened securely around the base of the tree three inches below the top level of the soil, the sides of the cage being formed by a large piece of screen tacked at the top to the tree and fastened to the screen floor at the bottom. The cages were large enough to allow considerable air space. A layer of duff consisting of lodgepole pine needles and small twigs was placed on the soil in the bottom of each cage. One hundred pupae were placed on the

duff in one cage and 225 larvae, in various stages of development, on the duff in the other cage.

From observations of the caged experiment conducted in 1928 it became apparent that if any definite results were to be secured it would be necessary to exclude ants and other predators from the cages.

With the 1929 experiment an effort was made to keep ants away from the caged trees by placing heavy oil or grease on the ground around the base of the cage. Old crank case oil was used around the base of the pupal cage and axle grease for the larval cage. A bear foraging for ants and grubs in the old stumps and logs nearby was apparently attracted to the larval cage by the axle grease. The cage was found totally wrecked and a large portion of the grease missing. The pupal cage only a few feet distant was not disturbed. A new cage was constructed for larvae. The floor of this cage was raised 14 inches from the ground level and tanglefoot paper fastened around the base of the tree below the floor of the cage (Figure 2). A thick layer of heavy cup grease was placed over the tanglefoot just below the bottom of the cage. A layer of soil was placed on the floor of the cage and a covering of duff on the soil. Fifty *P. monticolae* larvae were placed on the duff and the cage was tightly closed. This cage was also visited by a bear but no damage was done. A number of ants gained entrance into the pupal cage and destroyed nearly all the

first placing. One hundred pupae were added to replace them and more oil was poured in a small trench around the base of the cage.

The final examination of both cages was made on September 25, 1929, at which time the following results were recorded.

Larval Cage

<u>Number of attacks</u>	<u>Number of egg galleries containing</u>		
	<u>parent adults</u>		
15	None	One	Two
	7	6	3

This tree was attacked by *D. monticolae* in the upper portion above the wire-screen cage and a few attacks were found below the screen floor, the adult beetles boring through the tanglefoot paper to start their egg galleries, several of which extended up into the screened portion of the tree.

Comparison of Lengths of *D. monticolae* Egg Galleries Inside Larval Cage with those on Outside Above the Cage

<u>Inside Cage</u>		<u>Outside Cage</u>	
14 inches	6 $\frac{1}{2}$ inches	6 $\frac{1}{2}$ inches	14 $\frac{1}{2}$ inches
6 "	1 $\frac{1}{4}$ "	8 $\frac{1}{2}$ "	10 "
6 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "	18 "	11 "
7 "	17 "	7 "	10 $\frac{1}{2}$ "
5 $\frac{1}{2}$ "	19 "	5 $\frac{1}{2}$ "	6 $\frac{1}{2}$ "
11 "	15 "	7 "	10 "
15 "	7 $\frac{1}{2}$ "	10 "	7 $\frac{1}{2}$ "
14 $\frac{1}{2}$ "	12 "	7 "	23 "
5 $\frac{1}{2}$ "	22 "	5 $\frac{1}{2}$ "	13 "
Total number of attacks 15		Total No. of attacks for comparison 18	
" No. gallery inches 134		" " " gallery inches 131	
Average gallery length 10.2"		Average gallery length 10.0"	
Shortest gallery containing brood 4.5"		Shortest gallery containing brood 5.5"	
Longest gallery containing brood 22.0"		Longest gallery containing brood 23.0"	

Pupal Cage

The tree around which the pupal cage was constructed was also attacked in the upper portion above the cage. This attack occurred a week or ten days later than the attacks inside the cage.

<u>No. of attacks</u>	<u>No. of egg galleries containing parent adults</u>		
	<u>None</u>	<u>One</u>	<u>Two</u>
42	24	12	6

Comparison of Lengths of *D. monticolae* Egg Galleries Inside Pupal Cage with those on Outside Above the Cage

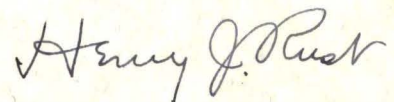
<u>Inside Cage</u>				<u>Outside Cage</u>	
<u>Inches</u>				<u>Inches</u>	
8	10	12	5	9	5½
8	9½	5½	10	9½	5½
5½	8	3½	7	9½	4
9	16½	27½	5	6½	2½
5	5	8½	17½	6	6
8	6	19½	1	6½	5
15	9½	20½	8	7	5
14½	4	17½	6½	13½	6
7	11½	6	5	9	14
2	12½	2	--	7	--
15½	7	6	--	5	--
<hr/>				<hr/>	
Total No. of attacks 42				Attacks for comparison 20	
" " " gallery in. 363½				Total No. of gallery inches 142	
Av. gallery length for the first 20 galleries 9.0"				Av. gallery length for the 20 galleries 7.1"	
Av. gallery length for the 42 galleries 9.1"				<hr/>	
Shortest gallery containing brood 2.0"				Shortest gallery containing brood 2.5"	
Longest gallery containing brood 27.5"				Longest gallery containing brood 14.0"	

SUMMARY

The caged Dendroctonus monticolae survival experiment as conducted for the year 1929 was far more productive of results than in the preceding year. Two factors were responsible for the results obtained: (1) the experiment was instituted a month later in 1929, missing some of the inclement weather experienced in 1928; and (2) the preventative measures used to exclude ants from the cages while not entirely successful with the pupal cage, permitted a large number to reach maturity and successfully attack a green standing tree.

Predatory agents were successfully kept out of the second larval cage. Considering that the larvae were in various stages of development when placed in the cage, the percentage which reached maturity substantially proved that D. monticolae adults, pupae, and mature larvae, when removed from their natural environment and placed on the duff on the ground, can complete their development and successfully attack green standing trees if not molested by predatory agents.

Respectfully submitted



Henry J. Rust
Senior Scientific Aid

January 23, 1930

Figure 1. Wire screen cage constructed around the base of a green standing lodgepole pine. D. monticolae pupae were placed on the duff on the floor of this cage and a number of them reaching maturity attacked the base of the tree enclosed in the cage. Forty-two attacks were recorded, with egg galleries varying from 2 to 27 $\frac{1}{2}$ inches in length. This tree was also attacked above the cage by D. monticolae, a few of the pitch tubes showing in the picture.

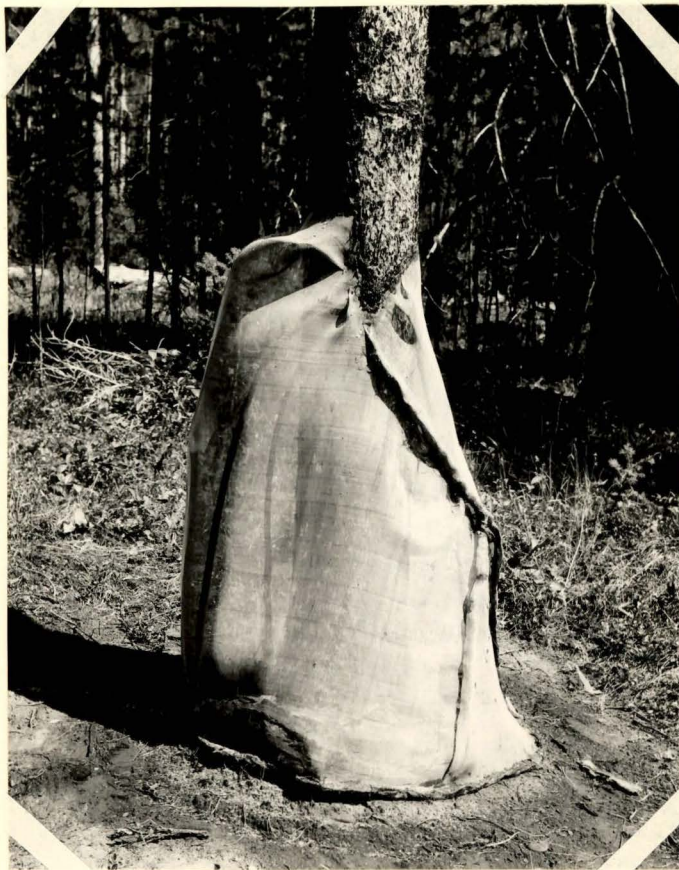


Fig. 1

M. H. R.

Figure 2. Wire screen cage constructed around the base of a green standing lodgepole pine. Fifty D. monticolae larvae were placed on the duff on the floor of this cage and a number of them reaching maturity attacked the base of the tree enclosed in the cage. Tanglefoot paper was tacked around the base of the tree below the floor of the cage and heavy cup grease was used over the paper at the junction of the screen and tanglefoot. Eighteen attacks were recorded, with egg galleries varying in length from $4\frac{1}{2}$ to 22 inches. This tree was attacked above the cage by D. monticolae.



Fig. 2

H.R.